



Psychological symptoms and health-related quality of life in idiopathic environmental intolerance attributed to electromagnetic fields



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ABSTRACT

Objective: Need for better understanding of the etiology of idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF) motivated the present study of psychological symptoms and health-related quality of life (HRQoL) in person who attribute health problems to electromagnetic fields.

Methods: Participants with IEI-EMF ($n = 114$) and a population-based sample of referents ($n = 104$) were investigated with six subscales of the Symptom Checklist 90 (SCL-90) to assess psychological symptoms, and with eight subscales of the Short Form (36) Health Survey (SF-36) to assess HRQoL.

Results: Significantly higher scores were found on obsessive/compulsive behavior, interpersonal hypersensitivity, hostility, phobic anxiety, paranoid thoughts in the IEI-EMF group compared to referents, whereas only a tendency of such a difference was found for psychotism. Furthermore, poorer HRQoL in the IEI-EMF group, compared to referents, were found regarding physical and social functioning, physical and emotional role limitations, general health, vitality, bodily pain, and mental health. Significant correlation with moderate to strong effect sizes were found between several of the SCL-90 and SF-36 subscales.

Conclusion: The results suggest that IEI-EMF is associated with various types of psychological symptoms and with poor HRQoL. Clinical implications include theoretical support for cognitive behavioral therapy, and, although further research is needed, that attention should be directed towards feelings of inferiority and uneasiness in relationships as well as anger, hostility and resentment towards other people.

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1. Introduction

It is quite common in the general population to report reactions to exposure to low levels of electromagnetic fields (EMFs). For example, as many as 13.5% of the Swedish population have been found to report annoyance attributed to visual display units and/or fluorescent lighting [7]. The prevalence of more severe cases in which symptoms are attributed to EMFs range from 1.5 to 5% [10,15,19,29]. Such symptoms include predominantly skin problems, general symptoms (e.g., fatigue), sleep problems, cognitive disturbances, and emotional problems [12,30,31].

There is no generally accepted bioelectromagnetic mechanism explaining the association between low-level EMF exposure and health effects [22], and no indications that persons with EMF-related symptoms would detect EMF at lower levels than most people or develop symptoms from EMF exposure per se [2,16,28]. For these reasons, the term idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMFs) has been proposed to be used to refer to symptoms attributed to electrical equipment [13], such as mobile/wireless phones and computer monitors. Instead of exposure factors, attention has in

recent years been directed towards individual factors, and there is support for a nocebo effect in triggering acute health effects [23,28].

In a review [26] it has been suggested that although the evidence base concerning treatment options for IEI-EMF is limited and inconclusive, best evidence currently available suggests that cognitive behavioral therapy (CBT) can be effective in IEI-EMF (see also [14]). Optimal efficiency of behavioral therapy, specifically designed for IEI-EMF, may require substantial understanding for the psychological character of persons with this condition. So far, high levels of perceived stress, stress susceptibility, burnout, worries of toxic interventions, tainted food and radiation affecting health, somatization, depression and various aspects of anxiety have been demonstrated in IEI-EMF [5,6,17,24,27]. The Symptom Checklist 90 (SCL-90) is a useful questionnaire instrument in this context, and provides broad information regarding psychological symptoms. Using the SCL-90, we have earlier, for the current sample, reported elevated levels of anxiety, depression and somatization [17]. A first objective of the present study was to analyze data on various other aspects of psychological symptoms based on the SCL-90, including obsessive/compulsive behavior, interpersonal hypersensitivity, hostility, phobic anxiety, paranoid thoughts and psychotism.

Due to the wide range of, often severe, health symptoms in IEI-EMF, one would expect health-related quality of life (HRQoL) to be compromised in these individuals. Due to large comorbidity with other types

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of environmental intolerance [25], the HRQoL may be particularly poor in IEI-EMF. Applying the Short Form (36) Health Survey (SF-36) in IEI-EMF, Rubin and collaborators [27] reported limitations in HRQoL regarding physical and social functioning, physical and emotional role limitations, general health, vitality, bodily pain, and mental health. Another objective of the present study was to revisit this topic by means of the SF-36. It was hypothesized that persons with IEI-EMF, compared to a reference group from the general population, would show high levels of psychological symptoms and poor HRQoL. Yet another objective was to study relations between the various aspects of psychological symptoms and HRQoL in IEI-EMF and a reference group.

2. Methods

2.1. Participants

Individuals who reported symptoms that they attributed to use of mobile/wireless phones, computer monitors or other electronic equipment were invited to participate through advertisement in eight Swedish newspapers. Those who responded were mailed a questionnaire. Of 160 persons who responded to the advertisement, 117 agreed to participate. Among these, 114 responded to the SCL-90 and SF-36, constituting an IEI-EMF group. In addition to the general question of symptoms associated with use of mobile/wireless phones, computer monitors or other electronic equipment, an inclusion criterion was reporting at least one of the specific symptoms in Table 1 when using at least one of these types of equipment. Number of participants in the group with IEI-EMF who reported specific symptoms attributed to each of the three different sources are given in the table. Mean (SD) duration of EMF-related symptoms in the IEI-EMF group was 11.2 (6.0) years.

For each of the 117 persons with EMF-attributed symptoms who returned a questionnaire, two controls, matched with respect to age and sex to the IEI-EMF group, were recruited through the Swedish population register and sent a questionnaire. Of these 234 individuals, 106 agreed to participate, of which 104 responded to the SCL-90 and SF-36, constituting a reference group. The two groups are described in Table 2 with respect to age, sex, employment status, and work capacity.

The work was carried out in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. The study was approved by the Umeå Regional Ethics Board, and all participants gave their informed consent to participate.

2.2. Questions and questionnaire instruments

The questionnaire included questions about symptoms attributed to electrical equipment (Table 1), demographics, employment status and

Table 1

Number of participants (%) in the group with idiopathic environmental intolerance attributed to electromagnetic fields who reported specific symptoms attributed to different sources.

| | Mobile/wireless phone | Computer monitors | Other electronic equipment |
|------------------------------|-----------------------|-------------------|----------------------------|
| Dizziness | 41 (36.0) | 25 (21.9) | 40 (35.1) |
| General discomfort | 67 (58.8) | 45 (39.5) | 56 (49.1) |
| Concentration difficulties | 45 (39.5) | 41 (36.0) | 37 (32.5) |
| Memory loss | 32 (28.1) | 24 (21.1) | 28 (24.6) |
| Fatigue | 40 (35.1) | 43 (37.7) | 39 (34.2) |
| Headache | 52 (45.6) | 38 (33.3) | 36 (31.6) |
| Warmth behind/around the ear | 77 (67.5) | 8 (7.0) | 13 (11.4) |
| Warmth on the ear | 76 (66.7) | 10 (8.8) | 10 (8.8) |
| Burning skin | 49 (43.0) | 50 (43.9) | 42 (36.8) |
| Tingling/tightness | 39 (34.2) | 43 (37.7) | 36 (31.6) |
| Sleeping problems | 29 (25.4) | 28 (24.6) | 37 (32.5) |
| Tinnitus | 28 (24.6) | 18 (15.8) | 25 (21.9) |
| Numbness | 29 (25.4) | 29 (25.4) | 27 (23.7) |

Table 2

Self-reported participant characteristics in the group with idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF) and referents.

| | IEI-EMF (n = 114) | Referents (n = 104) | p-Value |
|------------------------------|----------------------|------------------------|---------|
| Age, mean (SD), years | 49.2 (12.5) | 48.3 (12.4) | 0.615 |
| Women, n (%) | 85 (74.6) | 83 (79.8) | 0.357 |
| Employment status, n (%) | | | <0.001 |
| Full or part time employment | 44 (38.6) | 69 (72.6) | |
| Full or part time sick leave | 25 (21.9) | 11 (11.6) | |
| Disability pension | 30 (26.3) | 4 (4.2) | |
| Unemployed or retired | 15 (13.2) | 11 (11.6) | |
| Work capability, n (%) | | | 0.009 |
| Good | 51 (59.3) | 71 (80.0) | |
| Moderate | 17 (19.8) | 11 (12.4) | |
| Not so good | 18 (20.9) | 7 (7.9) | |

work capacity (Table 2), the SCL-90 and the SF-36. The SCL-90 [8] assesses psychological symptoms, and consists of 90 symptoms to be rated on a 5-point Likert scale, ranging from 0 (“not at all”) to 4 (“extremely”), regarding how frequently the symptom has been experienced in the past 7 days. For each symptom the question posed is “How much have you been bothered or distressed by...”. High score indicates high psychological symptomatology.

Of the nine SCL-90 subscales, results from the Anxiety, Depression, and Somatization subscales have been published elsewhere [17]. The remaining six subscales, for which data are presented here, are the Obsessive-Compulsive (O-C; 10 items), Interpersonal Sensitivity (I-S; 9 items), Hostility (HOS; 6 items), Phobic Anxiety (PHOB; 7 items), Paranoid Ideation (PAR; 6 items), and Psychotism (PSY; 10 items) subscales. The O-C subscale inquires unwanted urges to think certain thoughts or repeat certain behaviors (e.g., “Unwanted thoughts or ideas that just won’t leave your head”). The I-S subscale addresses how observant one is about other peoples’ behavior or changes in one’s environment, and feelings of inferiority in comparison to others, as well as feelings of inadequacy and uneasiness in relationships (e.g., “Your feelings being easily hurt”). The HOS subscale assesses thoughts and feelings of anger, hostility and resentment towards other people (e.g., “Having urges to beat, hurt or injure someone”). The PHOB subscale asks about disproportional or irrational fears and avoidance of unpleasant situations, people and things (e.g., “Feeling afraid in open spaces or on the street”). The PAR subscale treats thoughts and feelings of being followed or threatened from the outside (e.g., “Feeling others are to blame for most of your troubles”). The PSY subscale assesses incoherent and confused thinking (e.g., “The idea that someone else can control your thoughts”). The Swedish version of the SCL-90 was used, which has been validated and standardized for the Swedish population [11].

The SF-36 [38] measures HRQoL, and contains 36 questions of which 35 cover eight health scales: Physical Functioning (PF; limitations in performing physical activities; 10 items), Role Physical (RP; degree to which physical health-related problems negatively impact on ability to perform work and other everyday activities; 4 items), Bodily Pain (BP; 2 items), General Health (GH; degree of both physical and mental health; 5 items), Vitality (VT; degree of strength and energy; 4 items), Social Functioning (SF; impact of health-related problems on social interactions; 2 items), Role Emotional (RE; impact of emotional problems on work and other everyday activities; 3 items), and Mental Health (MH; mental function and well-being; 5 items). One item of the SF-36 refers to change in health, but was not used here. The score can range from 0 to 100, and high score indicates high HRQoL. The Swedish version of the SF-36 was used, which has been validated and standardized for the Swedish population [32,33].

2.3. Statistical analysis

The two participant groups were compared on age with paired t-test, and on sex, employment status and work capacity with Pearson

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